Wellness

Preventing Heat stress

Heat is a serious physical hazard that threatens workers from late spring to early fall. The potential for exposure to this workplace hazard is reflected in a 1979 survey of workers' compensation cases. Agriculture led all other industries, including construction and mining, in the incidence of heat-related illnesses. When anyone's ability to respond to heat stress is exceeded, exposure can lead to reduced ability to perform good-quality work, increased accidents on the job, or heat-related illnesses. This fact sheet provides some basic knowledge about heat stress, first-aid treatment, and prevention.

HOW THE BODY RESPONDS TO HEAT

The body temperature for a human must be maintained within a very narrow range (98.6 + 1.8°F), regardless of work load or adverse environmental conditions. An increase in body temperature of 6.5°F above normal can result in death from hyperthermia. Maintaining an acceptable body temperature is critical to the well-being of anyone working in a hot environment. To achieve this goal, a balance must be struck between heat produced by a body at work and heat lost to or gained from the environment. The body initially responds to heat by sweating and by circulating blood closer to the skin's surface to lower the main body temperature.

When exposure to heat takes place over an extended period, a process of physiological adaptation called acclimatization occurs. Acclimatization may take weeks, although significant adaptation occurs within a few days of the first exposure. Once acclimatization is achieved, working in the heat results in increased production of a more dilute sweat (lower salt content) and less of an increase in heart rate and body temperature.

The body's ability to respond adequately to heat stress decreases with age and obesity. Older workers and obese workers are more vulnerable to heat-related illnesses and less capable of working in the heat. Pregnancy increases a woman's metabolic demands and may make her more sensitive to

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heat and humidity.

METHODS OF HEAT GAIN OR LOSS

The major physical processes by which the body gains or loses heat in a hot environment are: heat production by normal body functioning (metabolism), heat loss by evaporation, and heat loss or gain by convection and radiation. Metabolic heat gain is a by-product of both resting and physical exertion.

Evaporation is the cooling (heat loss) of the body that takes place when sweat evaporates from the skin's surface. The rate of this evaporative cooling is usually greatly increased by air movement across the skin. During strenuous workouts in very hot environments, sweat production may equal one quart per hour; this is usually sufficient to prevent overheating. Problems arise in warm humid environments because humidity and still air interfere with the body's ability to dissipate heat. Sweat that cannot be evaporated from the body, but drips from the skin, will not result in heat loss.

Convective heat loss or gain is the transfer of heat between the skin and surrounding air. When air temperature is higher than skin temperature, the body gains heat through convection. If air temperature is lower than skin temperature, the body loses heat. The rate of heat gain or loss depends upon the difference between air and skin temperatures and the presence of air movement (wind velocity). The use of fans to continually move cool air next to the skin and move away the air already warmed by the skin is a common method of cooling the body.

Radiation is the direct transfer of heat from a hot object (the sun, hot equipment, a furnace, or a warm wall) to another cooler object, such as a human body, without heating the air in between. The greater the temperature of an object the more radiation it emits and the warmer the person will feel.

HEAT STRESS

Heat stress occurs when the body builds up more heat than it can handle. High temperatures, high humidity, sunlight, and heavy workloads increase the likelihood of heat stress. Too much heat can also make workers lose their concentration or become fatigued or irritable and thus increases the chance of accidents and injuries. Understanding how to deal with heat stress can help to prevent or reduce accidents and is important to workers' health and well-being.

Heat Rash

Heat rash is an early signal of potential heat stress. It is commonly associated with hot, humid conditions in which skin and clothing remain damp due to unevaporated sweat. Heat rash may involve small areas of the skin or the entire torso. If large areas of skin are involved, sweat production is compromised, resulting in a decreased capacity to do work in the heat. Even after the affected area of skin is healed, sweat production will not return to normal for another 4 to 6 weeks.

Preventive measures are aimed at reducing exposure to hot and humid conditions each day. If heat rash does occur, precautions must be taken to avoid skin infections. Treatments include cleaning the affected area and applying mild lotions to it. Keeping the skin clean and dry for at least 12 hours each day will prevent severe heat rash.

Heat Syncope

Heat syncope is characterized by dizziness or fainting while standing still in the heat for an extended period. The condition results from blood pooling in the skin and lower part of the body and the consequent decrease in blood flow to the brain. Heat syncope is the least serious of heat-induced disorders. Its most serious aspect is that it may cause people to fall or injure themselves while operating machinery. Treatment consists of resting in a cooler environment. Prevention is based on acclimatization and avoiding long periods of immobility while at wait.

Heat Cramps

Symptoms include painful cramps or spasms in the legs, arms, or abdomen. The victim will probably sweat heavily. Spasms may occur during work or in the evening after work. Heat cramps are often caused by a temporary fluid and salt imbalance during hard physical work in hot environments. First-aid treatments for heat cramps include: applying firm pressure or gently massaging the affected muscle, resting in the shade or a cool place, and taking small sips of salt water (one teaspoon of salt per quart of cool water; plain water should be used for those with heart or blood pressure problems).

Heat Exhaustion

Heat exhaustion results from the reduction of body water content or blood volume. The condition occurs when the amount of water lost as sweat exceeds the volume of water drunk during the heat exposure. Heat exhaustion usually develops after several days of exposure to high temperatures. The victim of heat exhaustion may have some or all of these signs or symptoms: heavy sweating; clammy, flushed, or pale skin; weakness; dizziness; nausea; rapid and shallow breathing; headache; vomiting; or fainting.

First-aid treatments for heat exhaustion consist of the following:

Move the victims to a cool area.

Place them on their backs with their feet raised.

Loosen clothing and apply cool, moist cloths to the body, or fan the victim.

Slowly administer sips of salt water (plain water for those with heart or blood pressure problems).

Call a doctor, especially if victims faint or vomit.

Heat Stroke

Heat stroke is a life-threatening, heat-related disorder associated with working under very hot and humid conditions. The body may either lose its ability to regulate temperature, due to a failure of the central nervous system to regulate sweat control, or its normal heat-regulating mechanism may simply be overwhelmed. Heat stroke can result in coma or death. The early signs and symptoms of heat stroke include: **a high body temperature (104^{0}F or over) hot, dry skin that appears bluish or red; absence of sweat in 50 to 75 percent of victims; rapid heart rate; dizziness, shivering, nausea, irritability, and severe headache progressing to mental confusion, convulsions, and unconsciousness.**

A worker who becomes irrational or confused or collapses on the job should be considered a heat stroke victim, and medical help should be called immediately. Early recognition of symptoms and prompt emergency treatment is the key to aiding someone with heat stroke. While awaiting the ambulance, begin efforts to cool the victim down by performing the following:

- Move the victim to a cooler environment and remove outer clothing.
- Wet the skin with water and fan vigorously or repeatedly apply cold packs, or immerse the victim in a tub of cool (not ice) water.
- If no water is available, fanning will help promote cooling.

Factors that may increase the risk of heat stress include sleep distress, obesity, poor physical condition, lack of acclimatization, dehydration, and alcohol use. Many commonly used drugs may also interfere with the body's response to heat stress. Preexisting medical conditions, such as cardiovascular disease, diabetes, certain skin disorders, and some diseases of the central and peripheral nervous systems, can impair people's normal physiological response to heat stress. Consult your physician for more information concerning the above conditions.

PREVENTING HEAT STRESS

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Enhancing Heat Tolerance

Acclimatization (to heat) is a process of adaptation that involves a stepwise adjustment to heat over a week or sometimes longer. An acceptable schedule for achieving acclimatization is to limit occupational heat exposure to one-third of the workday during the first and second days, one-half of the workday during the third and fourth days, and two-thirds of the workday during the fifth and sixth days. The acclimatization procedure must be repeated after days off due to illness or a vacation of one week or more. To achieve acclimation, a person must work in the heat at the activity level required by the job. If the risk of heat stress is increased, additional acclimatization will be required.

Fluid replacement: Always drink plenty of water when in the heat. Simply relying on feeling thirsty will not ensure adequate hydration. To replace the four to eight quarts of sweat that may be produced in hot environments, people require one-half to one cup of water every 20 minutes of the workday. Water at 55^0F is preferable to ice water or warm water.

Physical fitness is extremely important. The rate of acclimatization is a function of how physically fit the individual is. The unfit worker takes 50 percent longer to acclimate than one who is fit.

Increasing Safe Work Practices

Limit exposure time. Schedule as many hot activities as practical for the coolest part of the day (early morning or late afternoon). Employ additional help or increase mechanical assistance if possible.

Minimize heat exposure by taking advantage of natural or mechanical ventilation (increased air velocities up to 5 mph increase the rate of evaporation and thus the rate of heat loss from the body) and heat shields when applicable.

Take rest breaks at frequent, regular intervals, preferably in a cool environment sheltered from direct sunlight. Anyone experiencing extreme heat discomfort should rest immediately.

Wear clothing that is permeable to air and loose fitting. Generally less clothing is desirable in hot environments, except when the air temperature is greater than 95^0F or a person is standing next to a radiant heat source. Then covering exposed skin is

beneficial to reducing heat stress.

A buddy system may also be helpful. It depends on a fellow worker's ability to spot the early signs of heat stress, such as irritability, confusion, or clumsiness. A ready means of cooling should be available at work areas where heat illness might occur.

Worker Health and Education

Periodic medical examinations may help identify workers who are at greater risk for heat-related illnesses. This is particularly important for those with preexisting health problems or older workers.

Drugs may alter the body's ability to deal with heat stress effectively. Health-care providers can provide important information about possible problems and make recommendations about safe work practices.

Alcohol use should be avoided when working in a hot environment.

Worker Health and Safety Education

All workers who are exposed to hot environments should receive basic instruction on the causes, recognition, and prevention of the various heat illnesses.

This article is adapted from one written by Wei Zhao and Ann L. Kersting, and published as Fact Sheet FS747 by Rutgers Cooperative Extension, The State University of New Jersey.✲